

Algorithms

Consider the following problem: Given a deterministic finite automata $M = \langle Q, \Sigma, \delta, q_0, F \rangle$ and an integer n , determine the number of strings of length exactly n that are accepted by M .

1. **Warm-up:** Consider the DFA, M_1 , in figure 1:

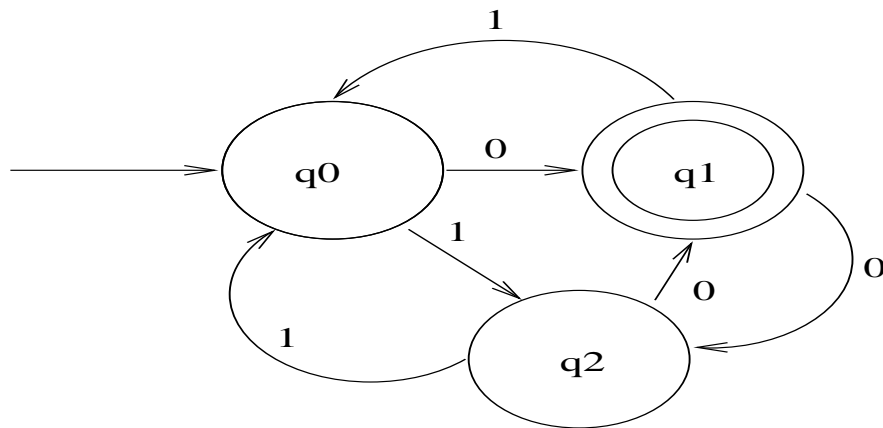


Figure 1: DFA M_1

List all the strings of length 3 that this automata accepts?

10 pts

2. Give a brute force algorithm to solve the general problem described above. What is the running time of this algorithm as a function n ?

30 pts

3. Devise a polynomial-time algorithm to solve the general problem. Analyze the running-time and space complexity of your algorithm.

60 pts

Hint:

Let $C(q, k) = \#$ of strings of length k that are accepted by M if the automata is started from state q .

Think recursively about the function C .